NASA Acquisitions Pollution Prevention Office
Kennedy Space Center, FL 32899

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# Studies, Reports, and Recommendations in Support of the NASA Acquisition Pollution Prevention (AP2) Program at the John F. Kennedy Space Center (KSC), FL

**Status Report #3**
**January 2, 2004**

**NASA Contract: NAS10-03029**
**Task Order No. 1**

**International Trade Bridge, Inc.**
**1308 Research Park Drive**
**Beavercreek, Ohio 45432**

# Executive Summary

NASA Headquarters established the NASA Acquisition Pollution Prevention (AP2) Program Office in 1998 to help NASA Enterprises, Programs and Centers qualify and implement replacement materials or processes that reduce and eliminate the uses of hazardous materials (HazMats). As the support contractor to the AP2 Office, ITB staff provides engineering, technical and administrative program and project management support to the AP2 Program manager. This report covers ITB's performance under Task Order No. 1 for the period October 1 to December 31, 2003. The NASA AP2 Program operates in three distinct business entities:

- Agency,
- NASA / DoD, and
- NASA / International.

During this reporting period, ITB provided core program support across all three (3) business entities (NASA, DoD, and International). Activities included but were not limited to:

- Efforts required to complete appropriate research, program and project development;
- Analyses, risk and quality assessments;
- Strategic planning;
- Customer relations and Outreach; and
- Information management and website support and maintenance.

In December, Mr. Brian Greene replaced Mr. Robert Hill as ITB Program Manager, NASA AP2. A Ms. Katherine Torres is scheduled to replace Ms. Tess Hill as Program Analyst/Coordinator on January 5, 2004.

In support of the Agency Business Entity, ITB has continued execution of the Alternatives to Aliphatic Isocyanate Polyurethanes and Surface Preparation/Depainting Technologies projects with teleconferences and Face-to-Face meetings at Kennedy Space Center (KSC) and Stennis Space Center (SSC); the Convergent Spray Technology project with a teleconference and penning of draft Joint Test Protocol; and begun development of a Parts Washing Technologies project with two teleconferences.

In supporting the DOD Business Entity, ITB has continued involvement in the Support Equipment project that came to a close, resulting in two primers and a coating system approved for NASA use. The Lead-free Solder project is progressing, although the need to resolve some last-minute technical issues will delay the assembly of the test boards until February 2004.

In support of the International Business Entity, ITB has developed several C3P project ideas in the areas of VOC/solvent reduction and lead-free solder as a result of site visits to TAP Portugal, OGMA, and twelve electronics facilities in Portugal. These projects were a direct result of productive meetings held in November 2003 at prospective stakeholder locations in Portugal.

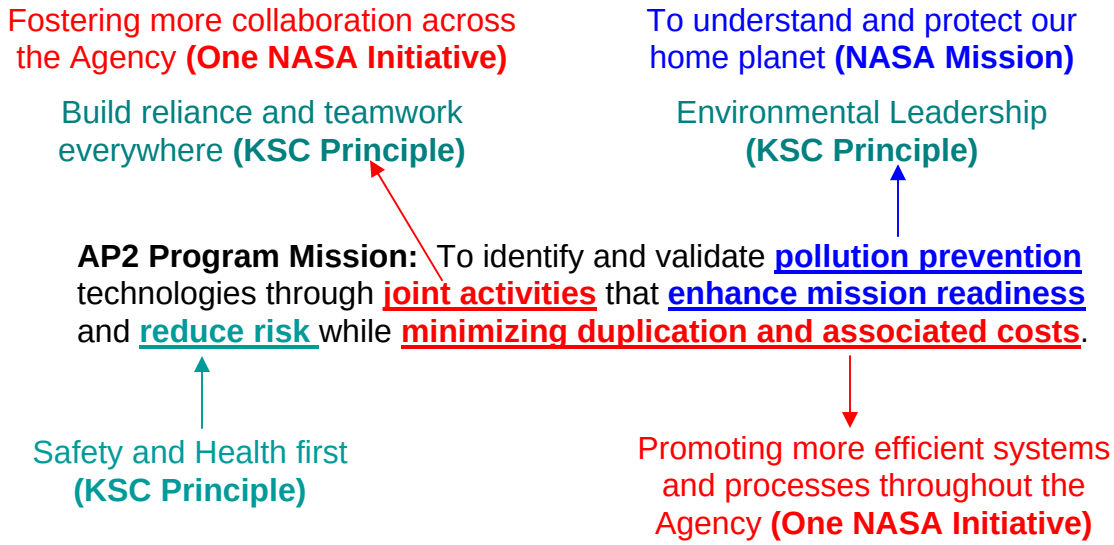
The following Status Report provides detailed information regarding all activities supported by ITB during this period of performance.

# Status Report

This Status Report for the NASA AP2 Program covers the period of October 1, 2003 through December 31, 2003. The report is divided into four major sections:

1. Core Program Support;
2. Agency Business Entity Support;
3. DoD Business Entity Support; and
4. International Business Entity Support.

The AP2 Program mission directly relates to the NASA mission, the One NASA Initiative, and Kennedy Space Center (KSC) Principles by focusing on collaboration between centers in identifying and testing more environmentally friendly technologies.




In enacting its mission, the NASA AP2 Program operates in three distinct business entities:

- Agency;
- NASA / DoD; and
- NASA / International.

The AP2 Office provides engineering, technical and administrative program and project management support. Projects may be exclusive to each business entity or shared by two or more in keeping with the Program's mission to identify common environmental issues and work collectively to find solutions that reduce duplication of effort, costs and technical risks.

# A. Core Program Support

Core program support activities are shared across and benefit program business entities (NASA, DoD, International). Activities include but are not limited to:

- Efforts required to complete appropriate research, program and project development;
- Analyses, risk and quality assessments;
- Strategic planning;
- Customer relations and outreach; and
- Information management and website support and maintenance.

## 1. Staff

The knowledge, skills, and abilities of the ITB contractors supporting the NASA AP2 Office allows the Program to meet its mission of helping NASA Enterprises, Programs and Centers qualify and implement less hazardous materials and/or processes. During this reporting period, the NASA AP2 Office was actively supported by the following personnel: Mr. Robert Hill, Program Manager; Mr. Brian Greene, Principal Senior Engineer and AP2 Office Technical Lead; Mr. Kevin Andrews, Senior Engineer; Mr. Kurt Kessel, Senior Engineer; Mr. Matt Rothgeb, Journeyman Engineer; Ms. Pattie Lewis, Journeyman Engineer; Ms. Tess Hill, Program Analyst/Coordinator; and Ms. Cassandra Carroll, Web/Database and Administrative Specialist. These personnel interfaced with senior NASA and DoD program and technical representatives, international executives, scientists, engineers, and numerous subject matter experts in the day-to-day development of program and project requirements and activities.

In December, Mr. Hill and Mrs. Hill chose to relocate out of state to pursue professional interests outside of NASA, and thereby ceased supporting the AP2 Program. On December 15, 2003, Mr. Brian Greene assumed the role of Program Manager and Mr. Kevin Andrews assumed the role of Technical Lead. A Ms. Katherine Torres has accepted an offer for the position of Program Analyst/Coordinator and is due to begin employment on January 5, 2004. Msrs. Greene's and Andrew's experience with the NASA AP2 Program will ensure continuity in the quality of ITB's support to the AP2 Program.

## 2. Regulatory Support

ITB provided regulatory support this period by reviewing applicable regulations, Executive Orders, NASA guides and handbooks, and international policies. ITB met its two regulatory support goals this reporting period as required by the NASA AP2 Program Manager:

1. To identify clear drivers for Agency P2 opportunities and
2. To monitor Shuttle Environmental Assurance (SEA) Initiative reporting of domestic environmental rules and regulatory impacts.

Accomplishments in these two areas are further discussed below.

**Regulations Affecting Projects**

In November and December 2003, Mr. Rothgeb identified and registered for several industry and U.S.EPA newsletters with the intent to stay informed about environmental regulatory changes and trends for future regulatory changes. To date, the only significant new or proposed U.S. environmental regulation is a new NESHAP (National Emission Standards for Hazardous Air Pollutants) being developed for surface coating, cleaning, surface preparation, and depainting operations at military and NASA facilities (see further discussion in SEA regulatory subsection below).

Also in November and December, Mr. Rothgeb updated many of the Project Summary Plans (PSPs) developed for the Agency projects being developed. These updates included further detail on environmental regulatory justification. Full updating of all PSPs will be completed by the end of January 2004.

**Regulations Affecting SEA**

Through participation in monthly teleconferences, ITB monitored the SEA's reporting of domestic environmental rules and regulatory impacts.

Mr. Andrews and Mr. Rothgeb provided support to the SEA in reviewing and providing input on the new NESHAP being developed for surface coating, cleaning, surface preparation, and depainting operations at military and NASA facilities. The (current) official title is "Defense Land Systems and Miscellaneous Equipment" NESHAP and it involves all military and NASA stakeholders. As part of this effort, the AP2 Office contributed to a glossary listing of terms and definitions applicable to NASA programs that should be incorporated into this document.

## 3. Business & Financial Plan Development

ITB provided business and financial plans for the administrative contract support of the NASA AP2 Program Office. The methodology and business systems used by the AP2 Program assure cohesion of technical and business applications providing quality products and services, delivered on time and within budget. During this period, ITB continued to:

- Track travel and materials budgets for proper program supportability;
- Fully provide office supplies; and
- Support and identify office equipment (printers and fax) operation capability - with no down time.

## 4. Status Reports and Schedules

ITB routinely prepares presentations and status reports with the goal of sustaining high quality and timely performance. During this period, ITB

- Maintained a master schedule of program activities;
- Maintained appropriate documentation and record keeping, e.g. calendars, meeting agendas, minutes, and action tracking; and
- Prepared draft presentations and maintained a presentation library.

The following paragraphs provide further details of these activities.

The Calendar of Events tool includes NASA, DoD and International program and project teleconferences, meetings and conferences, and other events involving the NASA AP2 Program Office. During this reporting period, the following events were identified.

| Entity | Teleconferences | Meetings | Conferences/Workshops |
|---|---|---|---|
| NASA AP2 | 4 | 6 | 2 |
| JG-PP | 13 | 2 | 2 |
| C3P | | 1 | |
| SEA | 3 | 1 | |

The Calendar is available upon request for specific dates of events, teleconferences,

meetings, etc. The Program and Project events are noted on the NASA AP2 web site.

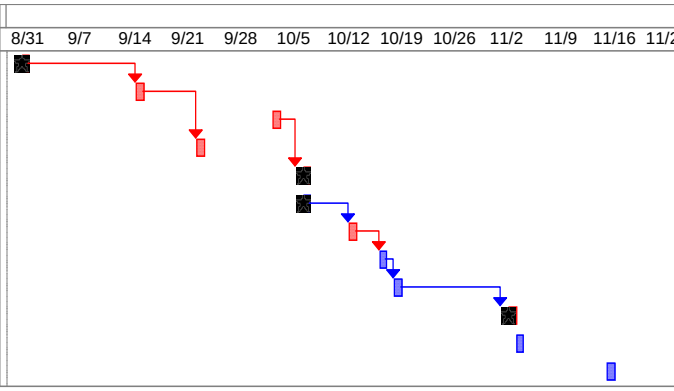
**Briefing Packages for Christina Brown:**

In October, ITB prepared PowerPoint slides summarizing the NASA AP2 Program for Ms. Brown's briefing to the NASA KSC Environmental Council (EC) at the O&C Building, KSC, FL.

On 10/10/03, Ms. Hill submitted the draft slides to Diane Callier for the EC Dry Run scheduled for October 16, 2003. After the Dry Run, Ms. Callier requested that Ms. Brown remove slides 7 & 13 for the final EC meeting. Ms. Hill removed the slides and created a CD for Ms. Brown along with speaker notes provided by Mr. Greene. The final version was presented to Ms. Callier on 10/20/03. The EC meeting was on November 19, 2003. No ITB support attended the meeting.

Ms. Hill developed the following MS Project timeline for this effort:

| ID | Task Name | Start | Finish |
|---|---|---|---|
| 1 | EC Meeting Notice | Wed 9/3/( | Wed 9/3/( |
| 2 | Point Paper(Suggestions) | Thu 9/18/( | Thu 9/18/( |
| 3 | EC Briefing provided to Chris | Mon 10/6/ | Mon 10/6/ |
| 4 | Point Paper Submitted | Fri 9/26/( | Fri 9/26/( |
| 5 | EC Briefing Submitted | Fri 10/10/( | Fri 10/10/( |
| 6 | Confirmation from Diane | Fri 10/10/( | Fri 10/10/( |
| 7 | Dry Run | Thu 10/16/ | Thu 10/16/ |
| 8 | Amend EC Briefing Action | Mon 10/20/ | Mon 10/20/ |
| 9 | Amended Briefing | Wed 10/22/ | Wed 10/22/ |
| 10 | EC Meeting | Thu 11/6/( | Thu 11/6/( |
| 11 | EC Meeting Rescheduled to 11 | Fri 11/7/( | Fri 11/7/( |
| 12 | EC Meeting | Wed 11/19/ | Wed 11/19/ |




## 5. Program Information Management Systems

ITB maintained various information management systems during this reporting period, including a Document Control System (DCS), an action item tracking tool, calendar of events, and other tools to track and integrate business and technical activities in all business entities. Two IM systems are further discussed below: DCS and KPRO.

**DCS (Document Control System)**

During this reporting period, ITB staff submitted forty-three (43) documents, which were assigned a tracking, number and entered into the DCS by Ms. Carroll. There are a total of sixty-seven (67) documents stored on the DCS along with a master copy of all documents also stored on Ms. Carroll's computer. A weekly back-up tape of the DCS is kept at the ITB South office.

**KPRO (Kennedy Space Center Projects and Resources Online)**

KPRO is a centralized project management information system tailored to the unique project management practices of NASA and KSC using Microsoft Project. It is web enabled to allow real-time updating of project schedules, budget information, status reporting and document sharing.

Ms. Carroll met with the AP2 Program Manager, Ms. Christina Brown, on 11/07/03 and was tasked to explore and learn the KPRO system in preparation for full use beginning with the next Task Order in April 2004. NASA has authorized four (4) contractor seats to have the KPRO software installed; this action was completed on the following dates:

Ms. Carroll on 11/14/03 and Mr. Greene, Mr. Kessel and Mr. Andrews on 11/26/03. Ms. Carroll loaded the initial AP2 Program schedule on 11/14/03 with a subsequent meeting with Ms. Brown and additional program information loaded on 12/01/03. Ms. Carroll and Ms. Brown will meet periodically in order to discuss the progress of this action.

## 6. Web Sites

During this reporting period, Ms. Carroll maintained and updated the NASA AP2 web site as needed. Ms. Carroll also updated input for program and project calendar of events data as needed. Ms. Carroll was scheduled to meet with the AP2 Program Manager, Ms. Brown, to discuss updates to the web site on 11/21/03 and 12/05/03, but Ms. Brown canceled these meetings due to other commitments. Ms. Carroll met with Ms. Brown to discuss updates on the web site on 12/31/03.

In October and November, ITB staff prepared brief written summaries of their recent trips to conferences and other important meetings for posting to the AP2 Web site. Specifically: Mr. Greene noted his 2003 Lead-Free Solder briefings to the NASA Workmanship Technical Committee Meeting, Air & Waste Management Association Conference, and Surface Mount Technology Association International Conference; Mr. Andrews noted significant observations and conclusions from his attendance at the 2003 Aerospace Coatings Removal and Coatings Conference; and Ms. Lewis noted her attendance at the 2003 Tri-Service Corrosion Conference.

Visibility of the AP2 web site is still limited as the site is kept behind the government-domain (.gov) firewall for security purposes. Ms. Carroll has submitted documents seeking approval for public access of the AP2 web site and is awaiting government input, projected for January 2004.

## 7. Integrated Technology Database

Before full-scale deployment, it has been agreed that the Integrated Technology Database (ITDb) will be reviewed internally by the NASA AP2 Office for its relevance as a tool in the identification of new projects and in evaluating pollution prevention opportunities.

To date the ITDb has been used to canvas NASA P2 needs and process owners in support of the JG-PP new projects selection effort.

On 11/03/03, Mr. Rothgeb attained access to the updated NASA Environmental Tracking System (NETS) to review hazardous waste numbers and P2 successes across NASA. The NETS information provided several interesting updates to the recommendations ITB made in previous P2 opportunity assessment reports. As such, ITB sees value in using the information in NETS to update the ITDb with hazardous materials use and P2 material/process implementations across NASA.

## 8. Customer / Stakeholder Interaction

During this reporting period, ITB personnel conducted internal and external meetings and other communications to track program/project status, complete action items, and assure customer satisfaction. Such interaction for specific projects is generally discussed later in this status report (Sections B, C, and D).

As discussed below, use of electronic mail continued to be an important mode of communication. As programs and projects develop, ITB develops and maintains a list of stakeholders for that program/project using MS Outlook software. These contacts are routinely updated as new members join or information on existing members

change. Keeping updated points of contact allows the AP2 Office to minimize time searching for new or updated contacts as new projects develop.

**Customer/ Stakeholder E-mail**

Ms. Tess Hill maintained virtually all MS Outlook e-mail distribution lists with the exception of those distribution lists for Agency projects, which were maintained by ITB technical staff. For example, Ms. Lewis maintains the distribution list for the NASA AP2 Projects, Alternatives to Aliphatic Isocyanate Polyurethanes and Surface Prep/Depainting for Structural Steel, with input by Mr. Andrews. ITB continued to update the project points of contact list for each NASA Center.

During this period, Ms. Hill maintained two e-mail distribution lists for Mr. Greene's Lead-Free Solder project and one list for the Joint Group on Pollution Prevention (JG-PP) Working Group. Specifically, the master (entire) Lead Free Solder project list was updated as follows:

| Date | Removed | Added | Changed |
|---|---|---|---|
| 10/24/03 | | 1 | |
| 10/20/03 | | 1 | 1 |
| 10/17/03 | 1 | 1 | |
| 10/15/03 | | 2 | 1 |
| 10/09/03 | | 1 | |

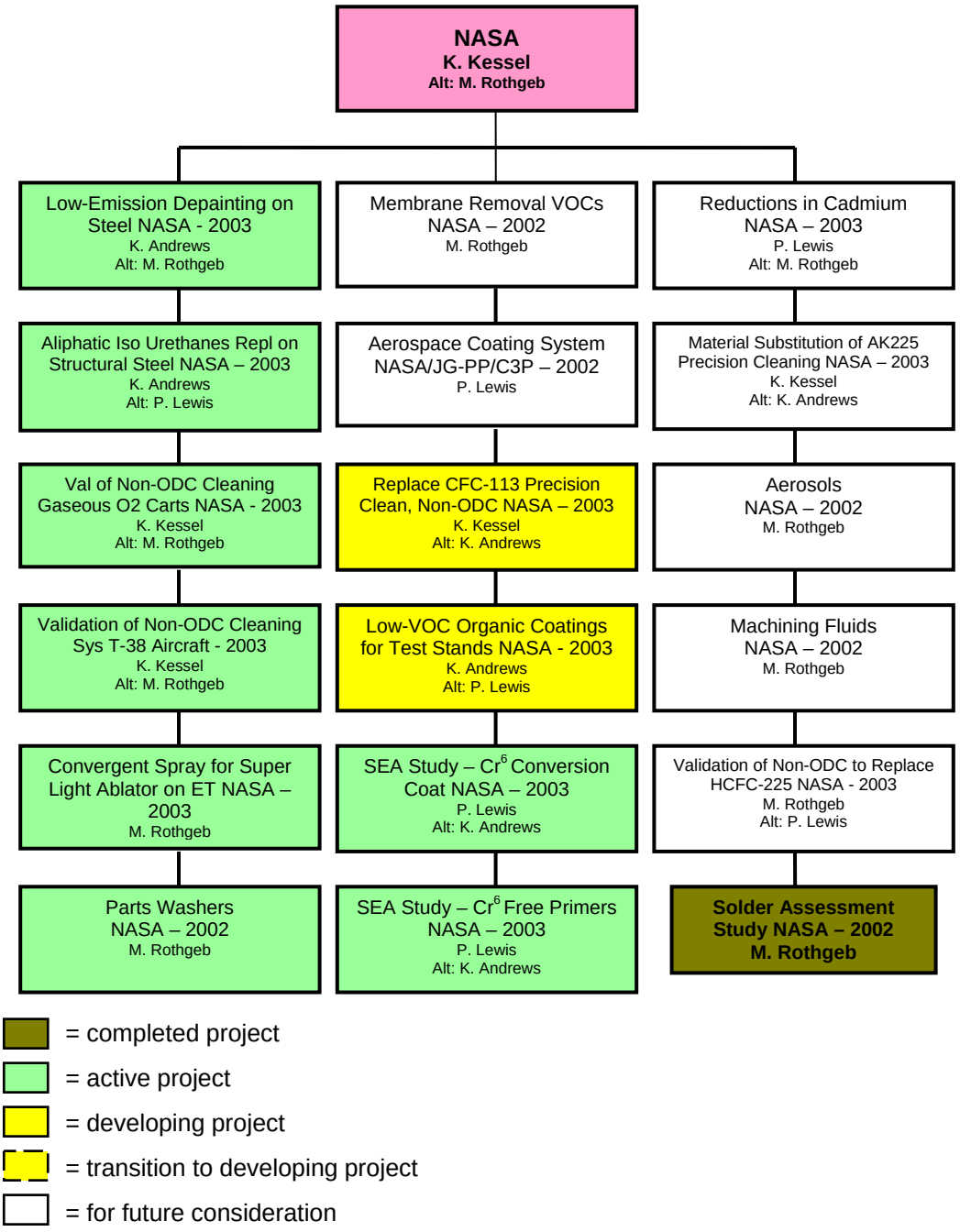
A second, smaller JCAA/JGPP Lead Free Solder e-mail list was created on 10/10/03 with 56 names and updated as follows:

| Date | Removed | Added | Changed |
|---|---|---|---|
| 10/24/03 | | 1 | |
| 12/02/03 | | 1 | |
| 12/03/03 | | 1 | |

## B. Agency Business Entity

ITB continued to identify, analyze and prioritize Center and Enterprise P2 needs. The result has been the recent development of a number of technical thrust areas and candidate P2 projects within the NASA community and with other external sources. A major focus of this reporting period was the initiation of several Agency P2 projects. With these projects, ITB staff is fostering cooperation between NASA Centers to reduce their HazMat profile, in the process epitomizing the "One NASA" objective. Figure 1 depicts the ITB engineering assignments to the 10 Agency projects that are active or under development, along with several other ideas for future project consideration.

**FIGURE 1 NASA Business Entity**



## 1. Professional Networking

ITB developed and maintained professional networks with all NASA Centers, major field installations, and Enterprise Program offices to help meet its goal of identifying project participants, new P2 needs, and possible solutions. In accomplishing this, ITB hosted two NASA P2 project face-to-face meetings and five project teleconferences, developed meeting minutes, and completed numerous telecons to define the technical objectives of candidate Agency P2 projects and further develop ideas for future projects:

1. Coating/Depainting Technologies
   - October 1, 2003 Teleconference
   - November 3, 2003 KSC Face-to-Face Meeting
   - December 3-4, 2003 SSC Face-to-Face Meeting
2. Support Equipment Coating Technology
   - October 21, 2003 Teleconference
3. Convergent Spray Technology
   - November 4, 2003 Teleconference
4. Parts Washer Technologies
   - November 6, 2003 Teleconference
   - December 4, 2003 Teleconference

In facilitating these meetings and teleconferences, ITB is not only developing and maintaining professional networks with numerous NASA Centers, major field installations, and Enterprise Program offices, but also helping meet the NASA AP2 Program goal of identifying joint solutions to commonly held P2 challenges. Specific examples of professional networking are discussed in the subsection below. More detail on the accomplishments of these Agency meetings and teleconferences is discussed in Section B.3, Five New Agency Projects.

**Development of NASA P2 Project Stakeholders**

During this reporting period, ITB updated its list of NASA facility technical points of contact for the active and developing AP2 projects. Several new and important project stakeholders were identified, including:

1. Parts Washer Technologies
   - 36 POCs across all NASA centers
2. Coatings/Depainting Technologies
   - 1 POC at Air Force Space Command Pollution Prevention Program

The increasing list of stakeholders (NASA and other) is representative of the increasing visibility of the program. This increases the effectiveness of the program exponentially as more people are made aware of the benefits related to teaming and reduced risk and resource commitment.

On 10/08/03, Mr. Greene contacted Mr. Joseph Osborne, Boeing Phantom Works, about his cadmium and chromium replacement efforts to look for applicability to NASA. Details of his response are in Sec. B.4.c. (Migration of Joint NASA / DoD Projects, Alternatives to Cadmium for Corrosion Protection and Threaded Part Lubricity Application (BISDS)).

On 10/09/03, Mr. Kessel contacted Mr. David Makufka, NASA Technology Commercialization Office (YA-C1), to discuss the Supersonic Gas-Liquid Cleaning System (see paragraph below). Mr. Makufka directed Mr. Kessel to contact Mr. Eric Thaxton, Test and Analysis Branch (YA-F2), to discuss the technology. During the conversation, Mr. Makufka and Mr. Kessel discussed the possibilities of working

together. The Technology Commercialization Office oversees a technology inventory database and a technology-tracking database for existing and developing technologies across NASA. Mr. Makufka stated that his office is always looking for customers for outlets to pass the technologies along to. Mr. Kessel indicated that the NASA AP2 Office could use the databases to find candidate technologies for current and future project development. Ms. Brown indicated she would contact Mr. Makufka to set up a meeting in which the NASA AP2 Office and the Technology Commercialization Office can discuss the possibilities of working together.

On 10/23/03, Mr. Kessel contacted Mr. Thaxton, YA-F2, to inquire about a Supersonic Gas-Liquid Cleaning System that was developed at KSC. The technology was mentioned in several articles touting the development of a new non-abrasive cleaning system for the precision cleaning of a wide range of components and systems eliminating the need for CFC-113 and other chlorofluorocarbons (CFCs) currently used for precision cleaning procedures. The Supersonic Gas-Liquid Cleaning System works by mixing air and water from separate pressurized tanks and ejecting this mixture at supersonic speeds from a series of nozzles at the end of a hand-held wand. The articles in which the Supersonic Gas-Liquid Cleaning System was discussed were dated 1996-1997, the NASA AP2 Office wanted to determine what became of this technology and where at NASA this technology was being used.

Mr. Thaxton clarified that the Supersonic Gas-Liquid Cleaning System was developed to replace CFC-113 for NVR cleanliness verification and to eliminate the use of soaps and detergents from precision cleaning processes performed on stainless steel. Aircraft wheels and laser cartridges were given as examples. Mr. Thaxton stated that the Supersonic Gas-Liquid Cleaning System never progressed any further than the testing development stage within NASA. The Wiltech Facility, located at KSC, tested the Supersonic Gas-Liquid Cleaning System and found the system to be labor intensive and difficult to use. The cleaning process was very tedious, requiring the nozzle to be ¼ to ½ an inch from the article to be cleaned. The technology was licensed to Va-Tran Systems of Chula Vista, California. Mr. Thaxton was unsure of the technology's current status but commented that companies in the semiconductor business may be using Supersonic Gas-Liquid Cleaning for cleaning high precision optics and other similar small, highly precise cleaning processes, possibly using robotic equipment.

ITB does not plan to further pursue this technology as a candidate for NASA AP2 demonstration, but will maintain information on it for reference purposes.

## 2. SEA Support

ITB staff, particularly Mr. Andrews, Mr. Greene and Ms. Lewis, actively interfaced with members of the Shuttle Environmental Assurance (SEA) Initiative to offer technical knowledge relevant to SEA activities and studies for P2 Project development. The top three priorities for SEA for which ITB is assisting are:

- Chromated Conversion Coatings Replacement
- Chromated Primer Replacement
- Cadmium Replacement

ITB engineers Andrews and Lewis participated in the SEA Face-to-Face meeting October 8-9, 2003 and a SEA Cadmium Replacements teleconference on 12/09/03. At the SEA Face-to-Face, Mr. Andrews and Ms. Lewis provided technical and project management support to Ms. Brown on a variety of SEA issues including the SEA collaborative studies. Ms. Lewis gave a briefing at the Face to Face meeting in October regarding the information the AP2 Office had gathered regarding the collaborative studies. Following the meetings and teleconferences, Mr. Andrews and Ms. Lewis supported action items assigned to them for the chromium and cadmium replacement studies.

Mr. Greene agreed to brief the SEA Steering Group on the JCAA/JG-PP Lead-Free Solder project at their January 2004 teleconference.

## 3. Five New Agency Projects

During the reporting period, ITB actively worked with NASA Centers to meet ITB's goal of initiating five new Agency P2 projects. Previously, ITB recommended the following five (5) projects:

1. Identification, testing and validation of alternatives to Aliphatic Isocyanate Urethanes on carbon steel structural elements across NASA (Test Stands and Shuttle Support);
2. Identification, testing and validation of low-emission surface preparation/depainting technologies for carbon steel structural elements across NASA (Test Stands and Shuttle Support);
3. Validation of non-ozone depleting cleaning system for on-aircraft flushing of T-38 oxygen lines and/or in-place cleaning of gaseous oxygen carts;
4. Use of convergent spray technology to apply SuperLight Ablator to the External Tank at NASA MAF;
5. Identification, testing and validation of chrome-free conversion coatings for NASA Shuttle Elements (SEA collaborative study).

These five projects were recommended to the NASA AP2 Program Manager in September 2003 based on their ability to confer to NASA:

- Reduced legal and environmental liability in operations;
- Reduced Environmental, Health and Safety costs associated with current operations; and
- Multiple-Center interest and thus reduced Center (and Agency) resource commitment.

Accomplishments in the above the project areas are discussed in subsections below.

On 10/02/03, Mr. Rothgeb also began initial development of the Alternative Parts Washing Technologies project by contacting stakeholders at NASA centers and requesting their help in expanding the member list for this project. Parts washing was chosen because of perceived high NASA stakeholder interest and because NASA interest in the non-ozone depleting alternatives project was waning.

Throughout the reporting period, Mr. Rothgeb and Ms. Lewis saw to the updating of the Project Summary Plans (PSPs) and Staff Summary Sheets (SSSs) by the respective project leads. These documents were placed into a 3-ring binder for the NASA AP2 Program Manager to quickly and easily review at a moments notice.

### a. Coating Systems/Depainting Projects

Last reporting period, the NASA AP2 Program (with the input of Center Stakeholders) identified two projects under the technical area Coating/Depainting:

1. Identification, testing and validation of alternatives to Aliphatic Isocyanate Urethanes; and
2. Identification, testing and validation of “new” surface preparation/depainting technologies

Because identified stakeholders for the two projects are the same, project discussions of the projects proceeded simultaneously.

On 10/01/03, a teleconference was held to review the schedule of activities associated with penning the Joint Test Protocols (JTPs) and Potential Alternatives Reports (PARs) and to set a timetable for a Face-to-Face meeting. On 11/03/03, a KSC stakeholder meeting was held to review the testing requirements for the JTPs, the Baseline Processes, and the funding process. The first drafts of the JTPs and lists of potential alternatives were distributed to the stakeholders for review on 12/01/03.

A Face-to-Face meeting was held December 3-4, 2003, at Stennis Space Center, MS, to review the draft JTPs, review the lists of potential alternatives for inclusion in the PARs, and determine if Cost-Benefit Analyses (CBAs) are required. At the Face-to-Face, a plan for the Business and Testing Phase was reviewed that addressed agency and program funding and resource commitment. A tour of the Stennis Space Center facilities was conducted on 12/04/03, as well as a presentation by Stennis maintenance personnel on some of their major maintenance/corrosion concerns.

**b. Precision Cleaning Projects**

Despite persistent contact by Mr. Hill, Mr. Rothgeb and Mr. Kessel with personnel at JSC, JSC will not be supporting a demonstration of the Versar oxygen line cleaning system (OLCS) on a NASA T-38 aircraft. As a result, as of November, ITB's efforts switched to trying at get a demonstration of the OLCS at a non-NASA facility that coincidentally maintains T-38 aircraft like NASA uses.

To meet this modified objective, Ms. Chris Brown, NASA, and Ms. Linda Willis, Air Force, called a meeting on 11/07/03 to discuss the future of the Versar oxygen line cleaning system and the possibility of establishing a location and date for a demonstration effort. Ms. Brown explained that NASA JSC will not support a demonstration effort on the T-38 aircraft maintained at Ellington Field, Texas. Ms. Brown stated that she was still interested in having a demonstration effort performed and asked Ms. Willis if it would be possible to have the demonstration performed at an Air Force depot. In support of this, NASA is willing to provide funding for the demonstration effort. Both Randolph Air Force Base and Columbus Air Force Base were discussed as possible locations worth investigating for the demonstration. The Air Education and Training Command (AETC), headquartered at Randolph Air Force Base, oversees the maintenance on the T-38. The Air Force would look into obtaining funding from AETC to help support the demonstration effort.

Mr. Kessel continued an effort to complete an Excel™ table that summarizes current precision cleaning processes conducted at NASA centers. To date, Mr. Kessel has received responses from nine space centers: GRC, GSFC, JPL, JSC, KSC, MAF, MSFC, SSC, and WSTF. Mr. Kessel plans discussions with Ms. Brown to determine if there is a need to press the four remaining centers to provide input for the table.

**c. Convergent Spray Technology (CST) Project**

Mr. Rothgeb held a CST project teleconference on 11/04/03, with dismayingly few NASA personnel in attendance. Prior to the teleconference, MAF personnel had noted to Mr. Rothgeb that their participation in future CST teleconferences would be limited or not be possible at all because of their time commitments to Return-To-Flight schedules. The MAF personnel noted, however, that they are still highly interested in the CST project and might have time to identify and provide to Mr. Rothgeb MAF's technical standards and testing procedures to help create the JTP. Because of the criticality of MAF's participation in the project, without such MAF technical information, work on the JTP will likely be severely hampered.

**d. Alternative Parts Washing Technologies**

On 10/06/03, Mr. Rothgeb held a meeting with the NASA AP2 Program Manager, Ms. Brown, to discuss the possibility of a project dealing with alternative parts washing technologies. Ms. Brown agreed with the proposed plan to perform a survey of current and past operations at NASA centers and gather information on alternatives in order to build a guide for the centers to use in replacing parts washers. NASA HQ has interest in this project and with being able to state that the footprint of this process across NASA has been explored and reduced to the maximum extent possible.

## 4. Migration / Joint NASA / DOD Projects

As reviewed below, ITB monitored JG-PP and other DoD P2 projects for applicability to NASA programs and process with the idea to maximize NASA participation and technology migration of completed and on-going projects.

### a. Nonchromate Coating Systems

Following ITB's discovery that the U.S. Air Force is using a Nonchromate conversion coating (PreKote X) on select aircraft, Mr. Andrews will be following up with the Air Force as to their experience with the PreKote X.

### b. Lead-Free Solder for Electronic Circuits and Components

Mr. Greene and Mr. Kessel continued to keep key personnel from NASA Centers, especially NASA MSFC and JPL, actively involved in the ongoing JG-PP Lead-Free Solder project. NASA POCs participated in scheduled Lead-Free Solder project teleconferences held on 10/16/03 and 12/05/03 during this reporting period. In addition, ITB kept in touch with technical efforts that NASA has underway with lead-free organizations such as the CALCE (Computer Aided Life Cycle Engineering) Electronic Products and Systems Center at the University of Maryland to coordinate this projects activity and reduce duplication of effort. (See Section B.5, NASA EEE Groups, of this Status Report for further details.)

In December, Mr. Greene signed up to participate in future NASA Electronic Parts & Packaging (NEPP) Program online virtual conferences via WebEx. Mr. Greene is scheduled to brief NEPP on the JCAA/JG-PP Lead-free Solder project at a March 2004 WebEx conference.

### c. Alternatives to Cadmium for Corrosion Protection and Threaded Part Lubricity Application (BISDS)

On 10/08/03, Mr. Greene received feedback from Mr. Joseph Osborne, Boeing Phantom Works, on the following Boeing cadmium and chromium replacement efforts:

- Boeing-DoD Cadmium-Free Electroplating for High-Strength Steels. Boeing is working on a project with the Air Force, Army, Navy and CTC to perform testing of alternatives to electrodeposited cadmium for landing gear. This project is entering the testing phase (ITB now has a copy of the test plan). Ms. Susan Van Scoyoc (814-269-2826, Vanscoy@ctcgsc.org) is the program monitor at CTC. This project's testing results will have interest among some Shuttle Elements (Orbiter, External Tank). ITB will follow up for further information since this is an area of interest to Boeing/Orbiter.
- Boeing Non-Implementation following JG-PP project, "Alternatives to Electrodeposited Cadmium for Corrosion Protection and Threaded part Lubricity Applications". Mr. Osborne confirmed that none of the promising cadmium-free coatings from the JG-PP project will be implemented at Boeing-Phantom Works because the Boeing plating shop closed down, nor will they be implemented at Boeing St. Louis because their manufacturing facilities were bought by another company.

- Boegel/AC-131 as Replacement for Chrome Conversion Coating for Aircraft Exteriors. Mr. Osborne provided to ITB a copy of his presentation from the September 2003 Aging Aircraft Conference, New Orleans, titled "Reducing the Costs of Corrosion Control: The Advanced Aircraft Corrosion Protection Program." The objective of the program (which is funded by USAF Aging Aircraft SPO) is to transition demonstration of a complete coating system using nonchrome Boegel/AC-131 as the conversion coating. Boegel would still be used with a chrome-containing primer (for long-term corrosion protection), but would at least remove chrome from the surface treatment step. Any resulting liquid wastes can simply be neutralized and sewered. Phase I laboratory comparison testing of coating systems containing Boegel/AC-131 vs. chrome-containing Alodine 1000 is underway. Preliminary results are that Boegel performs as well as Alodine 1000. Phase II operational testing of Boegel/AC-131 on F-15s and KC-135s is scheduled to start September 2004. Such a potential replacement for chrome conversion coatings represents another area of possible P2 interest for the Shuttle program.

**d. Low/No VOC and Nonchromate Coatings System for Support Equipment**

On 11/13/03, Mr. Kessel attended the final JG-PP project meeting for the Low/No-VOC and Nonchromate Coating System for Support Equipment at the Warner Robins, GA office of Science Applications International Corporation (SAIC), the contractor responsible for executing the technical work on the project. The meeting focused on seeking stakeholder approval of the final draft Joint Test Report (JTR) and to discuss the implementation plans for the services.

SAIC wrote the final JTR, which was completed and provided to the government in November 2003. Suggested changes to the JTR made at the meeting included reformatting and data organization so that the four coating systems that underwent field testing would have their own sections in the JTR, better organizing the data, and making the report easier to read.

During the meeting there was a lot of discussion on the implementation of coatings that met the stakeholders' requirements. Coatings and coating systems that met the specified requirements would be placed on the appropriate qualified products listings, which accompany military standards and specification documents. However, team members noted certain difficulties in typically getting specific products called out in technical orders as well as military specifications and standards. It was stated that modifications will be made to corrosion documents when applicable. Further information relating to the modifications that will be made to military standards and specification documents qualified products listing is specified in the final JTR.

The JG-PP Questionnaire for Project Implementation and Technology Migration was briefly discussed at the meeting. See Section C.3, Support JG-PP Projects, for further information on the development of the Questionnaire for Project Implementation and Technology Migration.

With this project coming to a close, Mr. Kessel continued efforts to migrate the promising coatings to support equipment within NASA.

1. The two approved primers (Ameron Dimetcote 9HS Zinc Rich Primer and DeVoe Catha-Coat 304H) and the approved topcoat (Ameron PSX 700) meet NASA standard NASA-STD-5008 (Protective Coating of Carbon Steel, Stainless Steel, and Aluminum on Launch Structures, Facilities, and Ground Support Equipment) definition of "low-VOC" coatings. Passing the 18-month beach exposure test also qualify the coatings for further testing towards being accepted. NASA-STD-5008 specifies that such pre-qualified coatings must "continue to provide acceptable protection and performance for a period of 5

years" in order to be accepted. Therefore, NASA will not be in a position to seriously consider implementing these coatings for launch structures until 2008.

2. The likelihood of NASA implementing any of these coatings after 2008 is difficult to predict at this time. Given that NASA-STD-5008 governs all support equipment at all NASA centers, it seems likely that the coatings won't be considered for implementation until at least 2008, when the coatings will have been exposed for an additional 5 years on the KSC beach. In addition, because no NASA POCs were involved in the development of the project's PAR or JTP, the nature and extent to which these coatings can be used within NASA is unknown to ITB at this time.

   - As a first step in identifying the nature and extent of the use of support equipment and the viability of the JG-PP-tested coatings, in September 2003, Mr. Kessel asked Mr. Dan Adams, NASA MSFC Environmental Officer, to reply to a number of questions. After an e-mail reminder from Mr. Kessel, the MSFC environmental manager finally replied on 10/09/03 that he was unable to get any of his three facility personnel to complete the form and offered no further assistance to ITB.

   - Due to the lack of responsiveness of Mr. Adams, Ms. Anne Meinhold, MSFC/ITB agreed on 10/21/03 to try to obtain the desired information, but she also was unsuccessful in obtaining a response from MSFC.

   - Mr. Kessel e-mailed Mr. Gene Harm, USA Environmental Management Office, on 10/30/03 to obtain information on coatings used for support equipment throughout KSC. No response was received. Ms. Brown indicated that she would be following up with Mr. Harm and other NASA and USA points of contact.

   - On 11/03/03, Mr. Kessel e-mailed Ms. Carolyn Kennedy, Stennis Space Center, MS, Code RA02 (Environmental Office), concerning the nature and extent of SSC's painting of support equipment.

**e. Non-ODC Oxygen Line Cleaning**

Despite persistent contact by Mr. Hill, Mr. Rothgeb and Mr. Kessel with personnel at JSC, JSC will not be supporting a demonstration of the Versar oxygen line cleaning system (OLCS) on a NASA T-38 aircraft. Efforts of the NASA AP2 Office will now be directed at getting a demonstration of the OLCS at an Air Force depot that manages the maintenance of T-38 aircraft.

**f. Portable Laser Coatings Removal System (PLCRS)**

Mr. Rothgeb attended the DoD Laser Applications Information Exchange for Maintenance and Sustainment Solutions Conference from December 9-11, 2003 in an effort to determine the next steps for NASA stakeholders regarding the PLCRS project.

Lasers were tested on various substrates to determine the feasibility of replacing conventional paint stripping technologies with laser technology. Of the three down-selected laser systems, two systems---an ND-YAG "Clean-laser" and an ND-YAG laser by Quantel---may be of future interest to NASA, depending on the application.

- The ND-YAG type "Clean-laser" may be useful for stripping small areas of paint from both composite and aluminum surfaces during shuttle refurbishment between flights and may also be useful for small area stripping of SRB components. The Clean-laser is best for selective stripping of topcoats or multi-layer coats, while leaving the primer or primary coats intact.

- The Quantel laser, also a ND-YAG type, could be effectively used by NASA as a replacement for glove-box stripping applications of small parts that have complex geometries.

Composite materials have undergone their second laser strip cycle and are currently undergoing structural testing; there are three more strip cycles remaining. Preliminary data shows that all the lasers are performing well for stripping from both metal and composite substrates. The limiting factor at this point is stripping time. Since the lasers are somewhat flexible in power, the heat and potential to damage the composite substrate can be reduced or eliminated, but this also reduces the strip rate.

The PLCRS group is planning on having several field demonstrations across the country in 1st quarter 2004 (target: March 2004). NASA personnel are invited to attend a demonstration of the Clean-Laser and Quantel laser at NADEP-Jacksonville, FL. Mr. Rothgeb is planning to contact USA SRB operations and Shuttle Operations personnel to find interest in attending these demonstrations.

In addition to the PLCRS project, several other DoD laser projects were discussed at the meeting. The US Air Force is currently testing laser systems for stripping specialty coatings such as Radar Absorbing Material (RAM), Chemical Agent Resistant Coatings (CARC), sealants/adhesives and carbon build-up from on and off-equipment components. Testing will be performed to validate the effectiveness of the systems and qualify the stripping technologies. They are planning to field test units to document the improvements in the depainting/decoating process as well as waste stream reductions.

MACTEC discussed the air sampling and toxicity results found when testing the PLCRS systems and the University of Dayton Research Institute discussed the effects on mechanical properties of aerospace materials from laser paint stripping in detail. Not all results from this testing is complete as laser stripping of the test panels will be continuing through next summer. Once all of this information is gathered, the complete findings will be made available from both groups.

Other Air Force investigations into portable laser systems, diode laser systems and the optimization of the PROTAL laser process from the University of France at Belfort were also discussed at the conference. One area of particular consideration for NASA is the Air Force's work with testing lasers for surface preparation prior to adhesive bonding with Sol-Gel. Studies are showing promise that the laser systems prepare the surface with a more even abrasion than currently used methods. The first phase was intended to determine if aluminum could be pretreated using an ND-YAG laser. The second phase, which has just begun, will be evaluating the effectiveness of commercially available lasers to pre-treat aluminum for Sol-Gel preparation. This may be of interest to NASA MAF and other locations where aluminum or metal to metal bonding is being performed.

## 5. NASA EEE Groups

Mr. Greene continued to network with members of NASA's EEE community regarding lead-free issues. Primary goals for this reporting period were to respond to a NASA Task Order to execute a "Lead-free Solder Survey Body of Knowledge," and secondly to support Agency needs for lead-free solder information/progress.

On 10/08/03, Mr. Mark Strickland, NASA MSFC, replied to Mr. Greene's request for a comparison between the objectives of various university-based lead-free solder research programs (e.g., the CALCE [Computer Aided Life Cycle Engineering] Electronic Products and Systems Center at the University of Md.) and the JCAA/JG-PP Lead-Free Solder project. Upon reviewing a summary of CALCE's latest projects prepared by NASA MSFC, it is clear there is no real duplication between JCAA and

CALCE. CALCE has one or two tasks that sound similar to JG-PP, but they are not the same. CALCE's lead-free solder studies do not begin to approach the scope of the JCAA/JG-PP project in the range of environmental testing, the number of samples, the types of lead-free solder alloys, the wide range of parts included, or the selection of test ranges to encompass the needs of the Military and NASA. Most CALCE efforts are survey tasks or tasks with limited testing to answer very specific (research) questions. NASA MSFC noted that the lead-free solder studies being performed at another university (Auburn University) under NASA MSFC's leadership and funding also do not duplicate what either JCAA or CALCE is doing.

In December, Mr. Greene received word that CALCE is interested in using some of the data generated by the Lead-Free Solder project in CALCE's mathematical models. CALCE would make the results available to the JCAA/JG-PP project consortium. Mr. Greene will follow up this solicitation in 2004.

In October 2003, Mr. Greene discovered (via Web page www.dscc.dla.mil/downloads/psmc/GIDEP03.ppt) that GIDEP (The Government Industry Data Exchange Program) had announced concerns about unknowns surrounding intermetallic growth occurring with lead-free soldered area array components. GIDEP is a cooperative effort in sharing information such as research, development, design, testing, acquisition and logistics information among government and industry participants in seeking to reduce or eliminate expenditures of resources. GIDEP issues alerts related to recalls of products or items used at home or in the office that may impact safety and health. In response to GIDEP's announcement, Boeing has already asked for and received permission to continue using lead-containing solder for the Shuttle/Orbiter program.

ITB is awaiting NASA direction to proceed with getting NASA MSFC's project, Lead-Free Solder Survey Body of Knowledge, under contract. The objective of this study is to perform a technology readiness overview of lead-free solder for NASA. The end product will be recommendations on what positions and measures NASA should take with respect to the introduction of lead-free solders. NASA MSFC proposed to use the NASA AP2 Program as the contract vehicle.

## 6. AP2 Financial Management Tools

ITB took the lead in helping JG-PP incorporate earned value management (EVM) techniques into JG-PP's methodology. ITB is implementing the same earned value concepts into the new NASA AP2 projects. Ms. Lewis developed a guidance manual on how to use EVM and a generic Microsoft Excel™ spreadsheet that project managers can modify to track earned value metrics for specific projects. These tools were submitted to the NASA AP2 Program Manager for approval on 11/26/03.

## 7. Prepare AP2 Project Technology Reports

Documentation of stakeholder performance and testing requirements; their decisions to down-select alternatives; and the testing results are integral parts of the AP2 project execution methodology. Such documentation ensures traceability of decisions, can enhance technology migration, and reduces future duplication of efforts. The following table summarizes the status of AP2 project technology reports.

| AP2 Project | PAR | JTP | CBA | JTR |
|---|---|---|---|---|
| Validation of non-ozone depleting cleaning system for on-aircraft flushing of T-38 oxygen lines and/or in-place cleaning of gaseous oxygen carts | Technology Transfer Project—PAR not required | Technology Transfer Project—JTP not required | A decision to prepare a CBA will be made after any demonstration | A final report will be published after demonstrations |

| AP2 Project | PAR | JTP | CBA | JTR |
|---|---|---|---|---|
| Identification, testing and validation of alternatives to Aliphatic Isocyanate Urethanes on carbon steel structural elements across NASA (Test Stands and Shuttle Support) | First Draft was submitted to stakeholders | First Draft was submitted to stakeholders | Awaiting development of JTP and PAR before determining need for CBA | Testing not begun yet |
| Identification, testing and validation of low-emission surface preparation/ depainting technologies for carbon steel structural elements across NASA (Test Stands and Shuttle Support) | First Draft was submitted to stakeholders | First Draft was submitted to stakeholders | Awaiting development of JTP and PAR before determining need for CBA | Testing not begun yet |
| Use of convergent spray technology to apply SuperLight Ablator to the External Tank at NASA MAF | Technology Transfer Project - PAR not required. | Second Draft completed and distributed to stakeholders for review. | Awaiting development of JTP before beginning CBA | Testing not begun yet |
| Identification, testing and validation of chrome-free conversion coatings for NASA Shuttle Elements (SEA collaborative study) | Awaiting initial responses to Requirements Surveys before beginning | Currently gathering testing methods and requirements from SEA Elements | Awaiting development of JTP and PAR before determining need for CBA | Testing not begun yet |
| Identification and validation of alternative parts-washing technologies. | Awaiting Initial responses to Requirements and Current Use Surveys before beginning. | TBD -- Awaiting Initial responses to Requirements and Current Use Surveys before beginning. | Awaiting PAR before beginning CBA. | Testing not begun yet |

Details of the status and plans for these documents follow.

**a. Potential Alternatives Reports**

Potential Alternative Reports (PARs) discuss the viable alternatives, the down-selection process, and the alternatives ultimately recommended for testing/implementation.

ITB has begun preparing PARs for the following projects: Alternatives to Aliphatic Isocyanate Polyurethanes and Alternatives to Surface Prep/Depainting Technologies. The first drafts of these documents were submitted to all stakeholders on 12/01/03 and reviewed by those attending the Face-to-Face meeting held December 3-4, 2003 at Stennis Space Center, MS.

**b. Joint Test Protocols**

Mr. Andrews began preparing JTPs for the Alternatives to Aliphatic Isocyanate Polyurethanes project and Alternatives to Surface Prep/Depainting Technologies project. The first drafts of these documents were submitted to all stakeholders on 12/01/03 and were reviewed by those attending a Face-to-Face meeting held December 3-4, 2003 at Stennis Space Center, MS.

Mr. Rothgeb prepared and distributed a second draft of the Convergent Spray Technology JTP to project stakeholders on 10/15/03. This JTP incorporated technical information from previous testing performed on SuperLight Ablators. Now, incorporation of test procedures and acceptance criteria into the JTPs is progressing.

**c. Cost Benefit Analyses**

Once feasible alternatives have been identified for each project, ITB will initiate work on the corresponding CBAs. Whether a CBA is required for projects will be determined based on input from the stakeholders after completion of the JTPs and PARs.

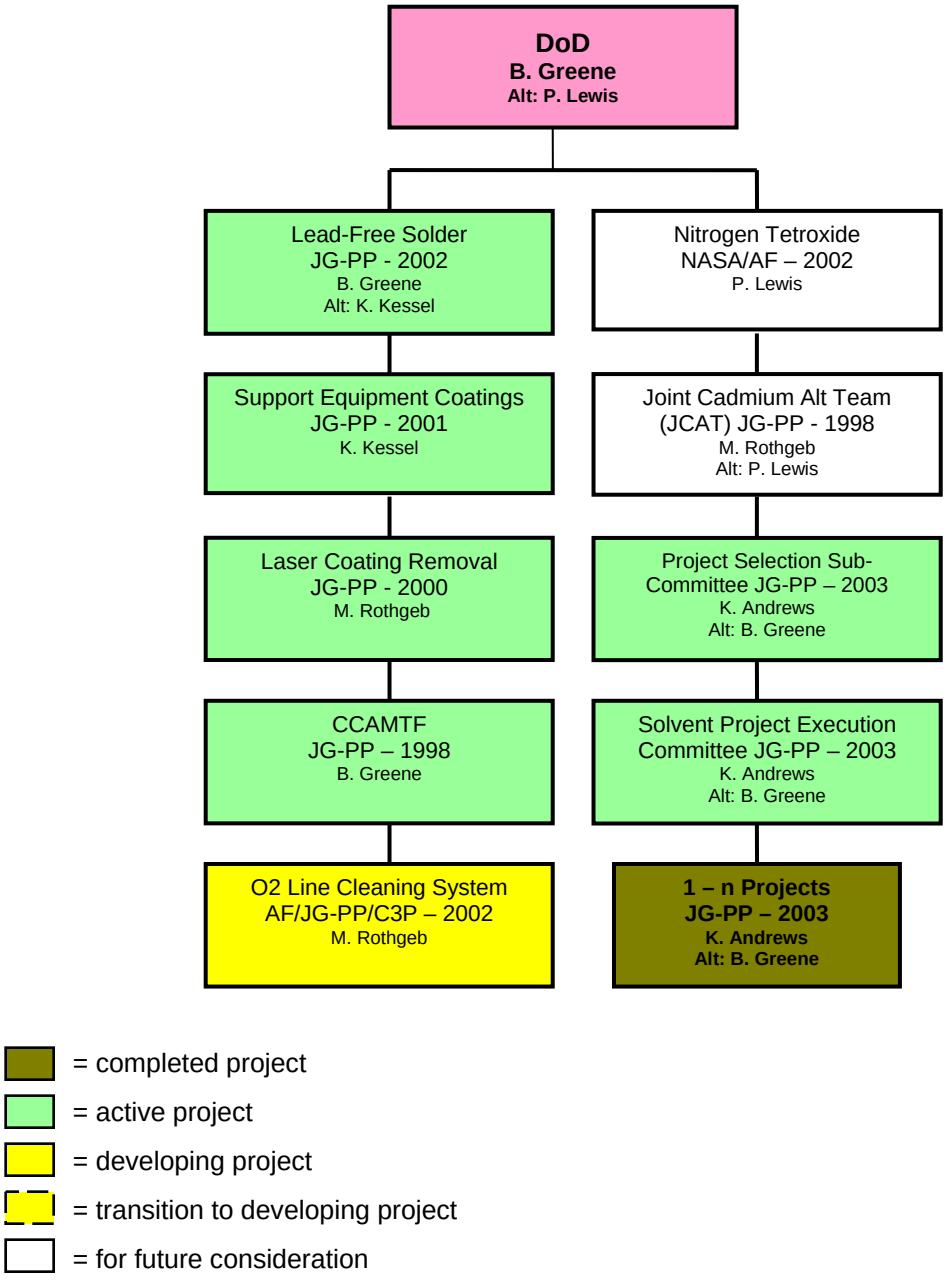
### d. Joint Test Reports

Once testing completes on Agency AP2 projects, ITB will prepare Joint Test Reports (JTRs). The JTRs will detail the test results and provide analysis and conclusions.

## C. DOD Business Entity Support

During the reporting period, ITB provided significant support to the Joint Group on Pollution Prevention (JG-PP) in its efforts to maintain environmental technology cooperation and qualify shared alternative material and process solutions that are less or non-hazardous to the environment. Some of this support involved identifying potential new projects and implementing earned value management, as discussed below. Figure 2 depicts the ITB engineering assignments to the seven (7) joint DoD/NASA projects that are active or under development, along with other ideas for future project consideration.

**FIGURE 2 DoD Business Entity**



## 1. JG-PP Working Group (WG) Support

ITB regularly supports the JG-PP WG through participation in teleconferences, business and technical meetings, Principals' Meetings, and Joint Logistics Commanders (JLC) Meetings. ITB personnel have a wealth of experience and knowledge of JG-PP operations. This support contributes to JG-PP's continued success and drive for continuous improvement.

JG-PP WG Teleconferences: ITB supported the following JG-PP WG teleconferences and the topics discussed therein.

**10/14/03 -** There were no formal minutes distributed for this teleconference. However, the following discussions occurred:
- Results and feedback from the Principals' meeting (All)
- Discussion on proposal plan for first new project start by the Project Selection Subcommittee (*CTC*)
- JG-PP End of Year Report (U.S. Marine Corp)
- Management Council Meetings (DCMA)
  - When are they?
  - How do we get invited to brief?
- Status of WG Action Items (*CTC*)
- Open Discussion (All)

**10/28/03 -** Due to the DOD Maintenance Symposium, 10/27-30, this teleconference was cancelled by the JG-PP Chair, Mr. Gary Leitner, and rescheduled for 11/04/03.

**11/04/03 -** The following discussions occurred:
- JG-PP Project Selection Subcommittee Update (*CTC*)
  - Project Plan Review
  - Execution Subcommittee Review
- Feedback from the DoD Maintenance Symposium (U.S. Air Force)
- Sample Letter and Schedule for Briefing the Management Council (NASA)
- Implementation Survey Form (NASA)
- End of the Year Report (*CTC*)
- Email System (*CTC*)
- Status of WG Action Items (*CTC*)
- Open Discussion (All)

**11/25/03** – The following discussions occurred:
- Execution Committee Kick-Off Meeting for Solvent Substitution (Mr. Andy Del Collo)
- Discussion with Mr. Tom Gorman at the JDMAG in regards to current efforts in the coating/corrosion technology fields, action item JWG.03.11.03 (Ms. Linda Willis)
- Project Selection Committee for Coatings (Mr. Ron Patun)
- Sample Letter for briefing Management Council (Mr. Dave James)
- Completed Projects' Implementation Statuses (Ms. Linda Willis)
- 2004 Conferences (Mr. Ron Patun)
  - Preparing a list for 2004
  - Ordering Giveaways
    1. Pens (only 6 boxes of 12 left)
    2. Neck totes (enough for 3 more conferences – keep the same or look for something new)

**12/09/03** – The following discussions occurred:
- End of Year Report (*CTC*)
- Feedback from the Defense Manufacturers conference
- Feedback from the SERDP/ESTCP Conference

- Upcoming German/American Data Exchange Agreement (DEA) Brief in Berlin
- JG-PP Principals and Working Group Meetings in Spring 2004
- JG-PP Working Group Action Items (*CTC*)

**12/23/03** - This teleconference was cancelled on 11/25/03 by the JG-PP Chairman, Mr. Gary Leitner

All JG-PP minutes are available upon request.

JG-PP Working Group Action Items relative to NASA:

**JWG.03.11.04**
Action: NASA to prepare a letter on JG-PP activities. The letter is to be forwarded to supplier environmental process engineering offices via DCMA Management Council co-chairs.
Status: NASA submitted its draft letter to DCMA in November 2003. DCMA is now the lead for this effort.

**JWG.03.11.08**
Action: JG-PP WG to review draft email system that was distributed and provide comments.
Status: NASA provided comments on 10/30/03.

**JWG.03.11.10**
Action: DCMA, The Marine Corps and NASA to review the Joint Methodology and send comments to Mr. Andy Del Collo.
Status: In progress.

**JWG.03.11.18**
Action: Review letter from action JWG.03.11.04 and provide comments from the Execution Committee to Mr. Dave James.
Status: In progress. The letter is still in draft format.

## 2. Shared Outreach Activities - Conferences

**Lead-free Solder Conference**
November 5 – 6, 2003
American Competitiveness Institute (ACI)
Philadelphia, Pennsylvania

Mr. Greene and Mr. Kessel attended the conference. Attending the workshop provided ITB a better working understanding of the issues surrounding lead-free materials to enhance ITB's coordination of the testing phase of the Lead-Free Solder project.

**Tri-Service Corrosion Conference**
November 17 – 21, 2003
Flamingo Las Vegas Hotel
Las Vegas, Nevada

Ms. Lewis attended the conference gathering information on new materials and technologies in the area of corrosion prevention and control and making contacts of possible interest to NASA.

**Fourteenth Annual International Workshop on Alternatives to Toxic Materials in Industrial Processes**
December 8 – 11, 2003
Radisson Scottsdale
Scottsdale, Arizona

Mr. Kessel and Mr. Andrews attended the workshop. The workshop provides a forum to discuss issues, concerns and successes relative to validating non-hazardous or low VOC solvents. Also addressed at the workshop was the impact of current and pending OSHA, EPA and DLSME NESHAP regulations on current practices in the armed services and NASA.

**DoD Laser Applications Information Exchange for Maintenance and Sustainment Solutions Conference**
December 9 - 11, 2003
Aladdin Resort and Casino
Las Vegas, Nevada

Mr. Rothgeb attended the conference to review the preliminary results of the Portable Laser Coating Removal System (PLCRS) project, as well as other DoD entities' current projects relating to laser systems used for similar maintenance issues.

## 3. Support JG-PP Projects

ITB provided technical support to the two key JG-PP projects noted below. ITB acted as the liaison to assure NASA requirements are being incorporated and to facilitate technology migration.

### a. Coatings for Support Equipment

Mr. Kessel and Mr. Greene participated in a Support Equipment technical teleconference on 10/21/03. The objective of this teleconference was to review the data collected from the last site visits, review the draft final report and discuss implementation planning.

Following the 10/21/03 project teleconference, Mr. Kessel and Mr. Greene met with the NASA AP2 Manager to discuss how best to summarize the results of the Coatings for Support Equipment project, not only for the JTR but also for NASA's internal use, and review a draft implementation survey form that ITB had prepared. None of the military service representatives attending the support equipment teleconference voiced clear implementation plans for coatings that passed testing. There was only mention of which coatings performed well and not so well. More than one stakeholder at the teleconference noted that they had not examined the JTR. Whether coatings that passed testing would or could be included in current specifications was also unclear at the teleconference and was not evident in the JTR. Ms. Brown stated that a feasible written product (i.e., implementation plan) must come out of this project. Mr. Kessel and Mr. Greene were directed to develop a checklist for implementation that could possibly be shared with the rest of the support equipment team. Mr. Greene stated that the CCAMTF checklist could be modified for this purpose.

Using the CCAMTF checklist as a start, Mr. Greene and Mr. Kessel developed a draft JG-PP Questionnaire for Project Implementation and Technology Migration. The questionnaire was presented to the JG-PP Working Group at the 11/04/03 teleconference. During the teleconference, it was noted that the survey was being developed because several projects are about to be completed. The Principals have directed JG-PP to complete more implementation and be able to provide tangible results for the implementations that have occurred. It was also discussed that the Implementation Survey Form could be used as a guide tool in the development of an implementation plan and the creation of a checklist that will help when gathering information about implementation. Ms. Brown asked Ms. Willis to see if the survey could be added to the agenda for the final project meeting being held on November 12-14, 2003; the item was subsequently added.

On 11/13/03, Mr. Kessel attended the final technical meeting for the project at Warner Robins Air Force Base, GA. The objective of the meeting was to discuss the final Joint Test Report (JTR) and to discuss the implementation plans for the services. There was much discussion on the issue of implementation and the difficulties associated with getting specific products called out in technical orders, as well as military specifications and standards. It was stated that modifications will be made to corrosion documents when applicable. Further information relating to the modifications that will be made to military standards and specification documents qualified products listings will be addressed in the final JTR.

Concerning the meeting agenda item, JG-PP Questionnaire for Project Implementation and Technology Migration: the Air Force project manager only briefly mentioned the survey at the meeting and no discussion followed.

**b. Portable Laser Coating Removal**

Mr. Rothgeb remained in contact with Mr. Eric Eichinger of Boeing to determine the success of composite panel stripping performed with the various laser systems. Initial test results show that some laser systems are capable of stripping composite materials without damaging the substrate. The strip rates are slower than conventional methods, but these may be increased in time. Considering the low-frequency use of stripping techniques on the Shuttle, the laser technologies may be of great use, but cost benefits will have to be studied to determine this for certain. To date, entire five-cycle stripping has been completed, but only a few types of substrate/coating. Mr. Jerry Mongelli and his group are continuing to strip and test panels and plans to complete all strip cycles by summer of 2004. Complete test results will be made available at that time.

The DoD Laser Applications Information Exchange for Maintenance and Sustainment Solutions Conference held on December 9-11, 2003, presented preliminary results of laser systems stripping paint from various substrates as well as other DoD entities' current projects relating to laser systems used for similar maintenance. The PLCRS project will soon be demonstrating the laser systems at several locations across the US and NASA is invited to bring components and test panels as well as personnel interested in participating in any demonstrations to the U.S. Naval Aviation Depot in Jacksonville, FL. Mr. Rothgeb will be contacting personnel at that facility to coordinate these efforts, likely to take place in the first quarter of next year.

## 4. Coordinate JG-PP Projects

**a. Lead-Free Solder (LFS)**

The major focus this reporting period was coordination of testing materials procurement and test board assembly procedures. The goal of beginning procurement of testing materials was met, but the goal of beginning board assembly was not met because of delays resulting from unexpected technical issues raised by the team members, which took time to resolve.

1) Technical Coordination

Mr. Greene and Mr. Kessel prepared for and facilitated seven project technical teleconferences this reporting period, on 10/03, 10/15, 10/16, 11/7, 12/1, 12/4, and 12/16. The following decisions were made at these teleconferences:

Test Board Design:

Component Finish-Solder Alloy Combinations and Placement. The combinations of component termination finish and solder alloy and where those components will be located on the board was specified by the team.

Board Size. Adequate free space has been added along two edges of the board to accommodate the wedgelocks needed for vibration testing.

Hole Diameter for Connector. The diameter of the plated through holes (PTHs) will be 0.036 and after plating should be at the very worst case diameter 0.031, sufficient to accept a 22-guage wire in support of the vibration testing.

Traces to Pads. The addition of pads for solder attachment instead of using the existing plated thru holes is a major design change and would add increased cost. Traces will not be run from the PTHs to pads on the edge of the board.

Label Plated Through Holes (PTHs). Markers will be placed every 1st, 11th, and 19th PTH so the entire length of the holes does not have to be counted.

Components to be Reworked. The exact four components to be reworked and their location were defined.

Testing Materials:

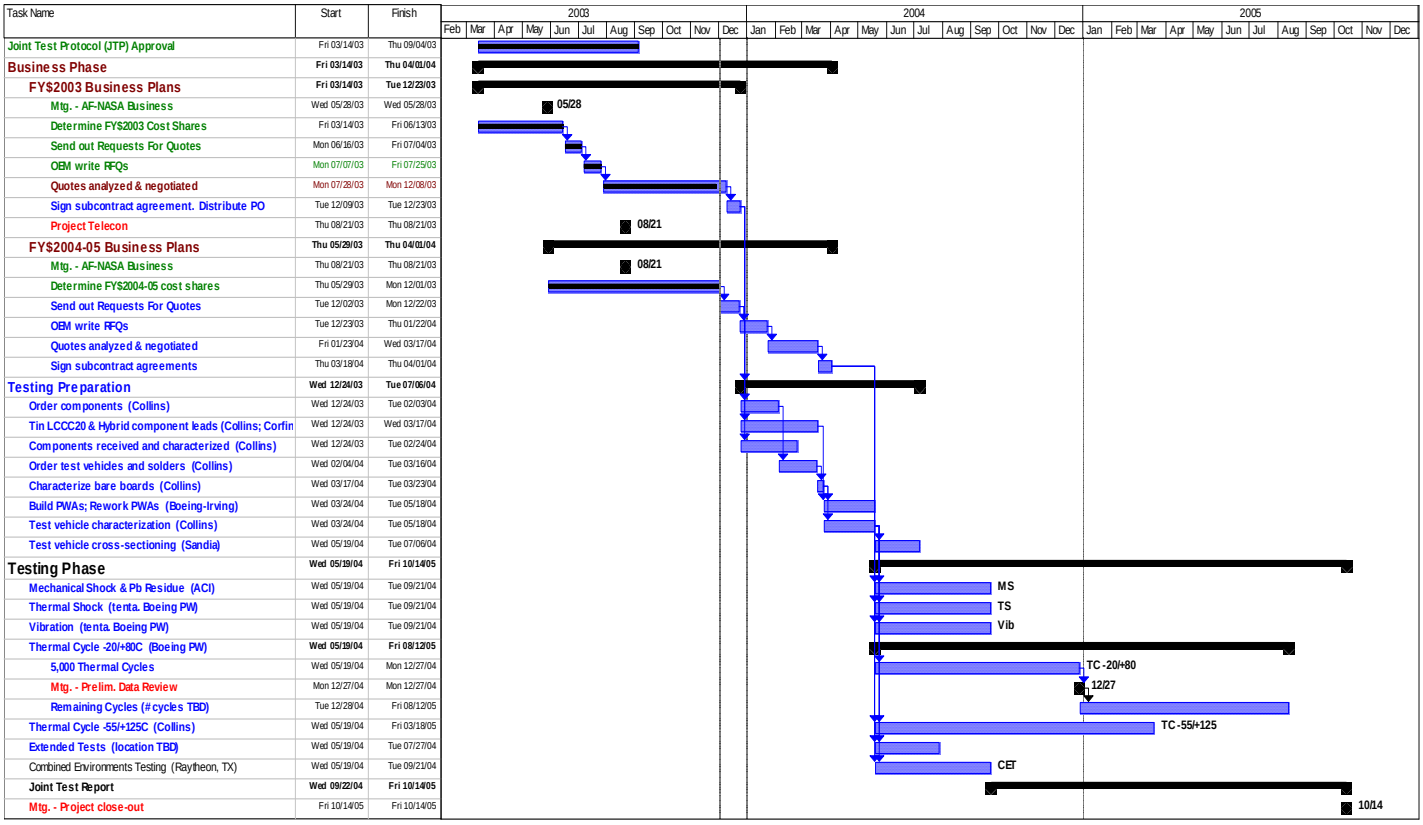
Solder Fluxes. All the fluxes to be used with each solder alloy were specified

JG-PP Documents:

Potential Alternatives Report. CTC prepared a final version of the PAR. At the Air Force's request, Mr. Greene reviewed and commented on the document on 10/03/03, noting some corrections to make.

Mr. Kessel and Mr. Greene continued to update the LFS project schedule (in MS Project) throughout the reporting period. The project schedule was updated to accommodate the extra time needed to make several necessary refinements of the components being procured, primary of which was the component termination finish-solder alloy placement combinations.

Below is the latest project schedule. This schedule was also provided to Ms. Carroll for possible uploading to KPRO.




In October, Mr. Greene reviewed the LFS project web pages and provided comments to CTC as to the content of the pages. ITB will continue to monitor the information on the LFS pages on a periodic basis to ensure that it is current and accurate.

On November 5-6, Mr. Greene and Mr. Kessel attended a lead-free workshop at the offices of the American Competitiveness Institute (ACI) in Philadelphia, PA. The workshop was comprised of two parts: a seminar and a hands-on session. A technical focus of the workshop was lead-free rework and post-soldering inspection. Attending the workshop provided ITB a better working understanding of the issues surrounding lead-free materials to enhance ITB's coordination of the testing phase of the Lead-Free Solder project.

Mr. Greene drafted one of the project team members (Dr. Tom Woodrow, Boeing-Seattle, WA) to speak about the LFS project at a November 11, 2003 local Electronics Manufacturers Association (EMA) meeting in Seattle. EMA was looking for someone who is knowledgeable about lead-free solder to discuss how a high tech company should be prepared to transition to lead free and how to deal with the problem of getting lead parts from suppliers that are switching to lead free.

2) Business Coordination

Mr. Kessel and Mr. Greene worked with Raytheon-Texas to attempt to accept Raytheon funds for the testing phase of the Lead-free Solder project. However, ITB HQ indicated that doing so presented numerous business and tax concerns and could not be done.

Mr. Greene also attempted to work with BAE Systems, Kent, England to attempt to accept $50,000 of BAE funds for the testing phase of the Lead-free Solder project. However, ITB HQ indicated that doing so presented the same business and tax concerns and could not be done.

## 5. Evaluate 15 New JG-PP Projects

ITB's focus for this reporting period was to assist CTC and the JG-PP Project Selection Subcommittee in developing one or more JG-PP projects for FY2004 (and subsequent FY2005 funding). The primary opportunity identified so far is solvent-free hand-wiping.

Hand-wiping P2 Opportunity

On 10/09/03, in response to an action item assigned to participants of a 10/07/03 JG-PP Project Selection Subcommittee teleconference, Mr. Rothgeb and Mr. Greene responded to CTC's request for details on NASA's solvent hand-wiping applications. ITB's submission, based primarily on PPONA data and the ITDb, included a table showing those NASA centers that perform solvent hand-wiping. As a supplement to this table, ITB also provided a second table discussing all the hand-wiping operations conducted at NASA centers, not just those operations identified by the Project Selection Subcommittee. Finally, ITB voluntarily provided an enhanced version of CTC's original questionnaire that ITB used to gather more detailed information about the nature of the hand-wiping applications within NASA.

As part of the above survey, ITB also evaluated a specific hand-wiping opportunity—Low/No VOC/HAP cleaners for aircraft fuel cells and fuel tanks—for which the Air Force already has funding. Mr. Greene and Mr. Rothgeb obtained some limited information about this project from the Air Force at a 10/07/03 JG-PP Project Selection Subcommittee teleconference, but the Air Force was unprepared to answer all the questions at that time. In general, this project would demonstrate a low/no VOC/HAP cleaner as a replacement for current MEK cleaning of aircraft fuel cells and fuel tanks. Potential Air Force stakeholders include F-16, A-10, and KC-135 weapon systems. Potential NASA applications include NASA aircraft from JSC and DFRC.

On 10/14/03, Mr. Greene reviewed and commented on CTC's written proposal for solvent wiping alternatives, making several suggestions to improve the readability of the document. The JG-PP Working Group approved moving ahead with further development of the wipe solvent project.

On 11/03/03, ITB responded to CTC's request for NASA (and the military services) to identify prior agency testing efforts on cleaning alternatives. To accomplish this, ITB completed a CTC worksheet identifying the NASA cleaning studies by name. In addition, ITB voluntarily provided two other new tables: one table provided a more detailed view of the tests to which NASA subjected specific alternative cleaners and a second table summarizing each NASA Center's status in converting to more environmentally-friendly wipe cleaners. These new tables were provided to facilitate a greater and more rapid analysis of data gaps among all the parties interested in the project. Finally, ITB provided an update of a table submitted earlier to CTC on the nature and extent of solvent hand-wiping within NASA.

## 6. JG-PP Financial Management Tools

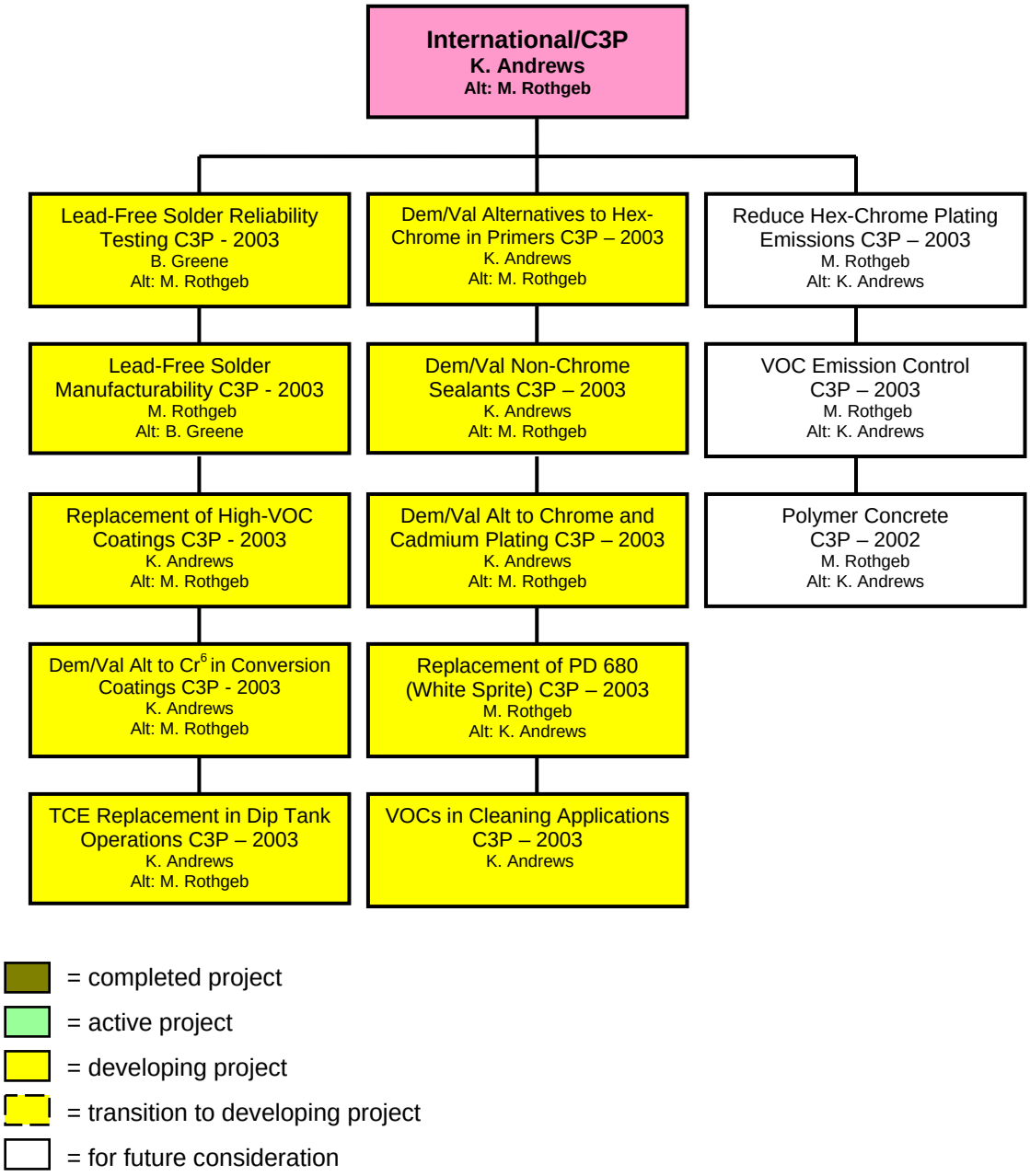
Ms. Hill identified an error in the JG-PP Core Program Financial Workbook that did not reflect NASA's core program contribution for FY2003. An adjustment to the JG-PP Core Program Financial Workbook was accomplished to accurately reflect the $50K of NASA funds contributed to the program activity. This adjustment was accomplished because the funding provided was initially identified in the "Prior years" column of the JG-PP Core Program Financial Workbook. Subsequently, the funding has been moved from "Prior Years" to FY2003 to properly reflect NASA contributions.

## D. International Business Entity Support

During the reporting period, ITB supported the Portuguese Institute of Environment and Centro Para Prevenção da Poluição – C3P (English translation: Center for Pollution Prevention) under the NASA/Portugal Joint Statement (JS) and the Terms of Reference (TOR). C3P is the AP2 counterpart organization in Portugal. Figure 3 depicts the ITB engineering assignments to the 10 joint NASA/International projects that are under development, along with other ideas for future project consideration.

.

**FIGURE 3 International Business Entity**



## 1. Program Support

Ms. Hill reviewed and made changes to content and format for the minutes for the post-Workshop and Joint Oversight Group Meeting. She distributed the minutes to Mr. Carlos Caldas, Ms. Christina Brown and ITB support in October.

## 2. Administrative Support

Only minor administrative support was provided during this reporting period. Primarily, this support was associated with the post-JOG and action item meetings and the preparation for deployment of three ITB engineers (Mr. Greene, Mr. Andrews, and Mr. Rothgeb) to Portugal in November to conduct further assessments.

## 3. Identify International Needs

### Lead Solder Activity

Twelve (12) electronics facilities in Portugal were visited by Mr. Rothgeb and Mr. Greene (along with ISQ personnel) from November 13-20, 2003. Seven (7) of these companies were in the Porto area and five (5) in Lisbon. Most companies were circuit card assemblers; one was a printed circuit card manufacturer. The size of the companies (and the size of the production lines) ranged from small to large.

Every company was different from the others in some way, with some being significantly different from others in terms of their product line and methods of soldering. Some were highly/totally manual and of low throughput; others were highly automated and of high volume production. Every facility, however, indicated that they had some need in the area of lead-free solder, either in terms of guidance needed or need for testing.

Recommendations:

Following are some preliminary ideas for subsequent C3P lead-free solder projects.

1. Project: Lead-Free Solder Reliability Testing Project for Class 2 (Industrial) Applications

   Some Portuguese firms have not made much progress in determining which lead-free solder alloys are best for them. This is partly because they are waiting for their customers (e.g., automotive companies) to define the requirements and recommended solder alloys. These companies, however, do not want to be surprised with any last minute requests to implement new materials and/or processes, so they are receptive to projects for validating lead-free solder alloys for their applications. Such applications appear to differ from the scope of the JG-PP project, such as including Class 2 (Industrial) performance environment, soldering of transformers and inductive coils, and possible use of slightly different soldering alloys.

2. Project: Lead-Free Solder Manufacturability Project for Class 2 (Industrial) Applications

   More than a couple of Portuguese electronics firms have set a lead-free conversion timetable and have completed or at least begun evaluating lead-free materials. These companies are now ready for the next step—solving the manufacturability issues associated with lead-free soldering, such as how high throughput and high quality can be achieved.

Timetable:

The following near-term steps were recommended:

1. Between 11/24/03 and 12/04/03, ITB-Kennedy Space Center and ISQ shared notes on the content and format of the LFS Assessment Report. The Report will include a common-needs assessment and a preliminary "gap analysis" to help justify and clarify two or more candidate projects. ISQ will author this report with input from ITB. The Report will include recommendations on discrete projects to present to prospective stakeholders.

   Between 12/04/03 and 12/18/03, ITB met its commitment of providing the agreed-upon information to ISQ.

2. In December to January 2003, ISQ will re-visit the Portuguese electronics companies, present the proposed project ideas, and solicit the nature and extent of the interest and in-kind contributions such companies are willing to provide to one or more of the projects.

   In mid-December, ISQ indicated they were late in beginning this step, but did not indicate concern in being able to complete it in time.

3. ISQ will take the lead in preparing and submitting one or more project proposals for Portuguese national funding and/or European Union funding (e.g., Sixth Framework).

4. Between February and April 2004, C3P will conduct one or more lead-free solder project kickoff meetings in Portugal with interested electronics firms. Objectives of such a meeting are to introduce the project, firm-up commitment, and refine the project(s) objectives.

**Coatings, Heavy Metals and Other HazMats at TAP Portugal and OGMA**

Mr. Andrews spent three (3) days at OGMA (November 13, 14, and 17$^{th}$) and three (3) days at TAP Portugal (November 18, 19, and 20$^{th}$) in support of C3P to review which are the most viable projects to initiate in 2004. Mr. Andrews focused primarily on C3P potential projects that address a reduction in the use of materials containing high levels of VOCs, heavy metals, and other hazardous components.

Common TAP Portugal and OGMA projects that have been identified include:

1. Replacement of high VOC coatings for aircraft painting and in general painting scheme.

2. Dem/Val of suitable alternatives to hexavalent chrome (Cr+6) in conversion coatings (AL 2024, 7075, 6061). Chrome Conversion Solution (Alodine 1200) – Cadmium and Chrome plating lines (Airbus Industrie process and material specification 01-02-02 and Mil-C-5541).

3. TCE replacement in dip tank cleaning and degreasing operations – this is a legal requirement that they cease using TCE by 2007.

4. Dem/Val of suitable alternatives to hexavalent chrome (Cr+6) in primer coatings (AL 2024, 7075, 6061).

5. Dem/Val of Non-Chrome sealants for the fuselage and other metal to metal panel joints.

6. Dem/Val of alternatives to Chrome and Cadmium plating on fasteners and engine components, landing gear and turbine fans.

7. Replacement PD 680 (White Sprite) – used to clean wheels, brakes and other engine components. They are attempting to use/test Sky Clean 1000 on the wheels and in some limited applications.

A timetable for further developing these opportunities was proposed by ITB, TAP and OGMA and agreed upon by Ms. Brown. First step is ITB's preparation and submission to C3P of a project plan no later than the 2nd week of January 2004.

## 4. Prepare C3P Letters of Agreement

No C3P/NASA Letters of Agreement were prepared during this reporting period. All areas of interests are still in the project development phase.

Mr. Andrews constructed and submitted to Ms. Christina Brown a draft letter outlining what should be conveyed between NASA/C3P and the Brazilian company, Embraer.

## 5. Coordinate C3P Projects

In October, Mr. Greene and Mr. Kessel developed an electronics manufacturing survey form for use by C3P in obtaining critical market and technical information from prospective Portuguese electronics manufacturers. ITB e-mailed the form to C3P on 10/06/03. Nine (9) of the 12 survey forms were received by the close of the site visits on 11/20/03. In December, ITB analyzed the data from these surveys to help arrive at recommended C3P projects and potential stakeholders. It was ITB's observation that these forms lent uniformity to the information gathering, including the face-to-face interviews in Portugal.

## 6. C3P Financial Management Tools

C3P financial management tools were not accomplished during this reporting period, as no projects were mature enough to warrant financial support.

## 7. Migration of NASA & DoD Technologies to C3P

ITB developed two possible technical exchange ideas in the area of lead-free solder:

1. Baseline Information Exchange to Portugal: JG-PP Lead-Free Solder Test Data of Interest to Portuguese Electronics Firms

   The objective of the ongoing U.S. (JCAA/JG-PP) Lead-Free Solder project is to gather baseline test data on some of the more promising lead-free solder alloys' performances under Class 3 (High Reliability) military and space applications, as applied by reflow, wave, and manual (repair) soldering. The end products of at least one Portuguese company matched the focus of the JG-PP project, and would be of at least some interest to Class 2 manufacturers. Therefore, one possible C3P project may be to share JG-PP's test data with Portuguese companies.

2. Information Exchange to USA: Low-VOC Flux Information of Interest to NASA

   While many electronics firms in the U.S. are preparing to use high-VOC fluxes for lead-free solder alloys, the Pioneer facility in Portugal is currently using a LOW-VOC flux for lead-free printed circuit board manufacturing (the solder paste is lead-free, while the components are still lead). The low-VOC flux appears to be working very well for their operations. The push to use a lower

VOC flux is directly tied to the European Union's desire to reduce VOC emissions throughout its united countries.

The low-VOC flux is produced by the Japanese Company, Tamura. Personnel at Pioneer said they would send MSDS and related product information to ISQ contacts, which will then send them to ITB-KSC.

NASA may have an interest in testing this low-VOC flux as an alternative to currently high-VOC fluxes used at NASA JPL, GSFC and DFRC. This information exchange could also potentially lead to a future NASA project to validate this low-VOC flux for any JG-PP qualified lead-free solders.

Pioneer has attempted to use No-VOC fluxes in the process, but with little success. This may also be of interest to NASA and other U.S. firms.

## 8. C3P Action Item Tracking Tool

Ms. Hill tracked seven Post-Workshop and two (2) JOG follow-on actions. As of this reporting date, there are three (3) Post-Workshop actions open. All JOG actions are closed.

## 9. C3P Information Management Systems

During the first part of this reporting period, Ms. Carroll maintained and updated the C3P web site as needed. On 10/07/03, Ms. Carroll published the briefings to the C3P web site from the 2003 C3P and NASA Technical Workshop, “Integrating Common Problems for Shared Solutions,” held in September 2003 in Lisbon, Portugal. Maintenance responsibilities of the C3P web site were turned over to General Branco on 10/08/03.

## Conclusion

The NASA AP2 Program remains a very viable and active Agency program. All ITB resources are fully employed in providing support to develop and maintain the current level of programmatic and project efforts across the three business entities. The ultimate success of each project remains subordinated to the level of strategic direction provided by NASA, the individual performance of the project integrator, and from the responsiveness of those identified as project stakeholders. The ITB project integrators will continue to identify the challenges and risks for maintaining the level of program and project activity being conducted to the NASA AP2 Program Manager for direction.